Background

Microorganisms and their byproducts are considered to be the major cause of pulp and periradicular pathosis leading to endodontic failure, hence the main objective of endodontics is to eliminate microorganisms and provide a hermetic seal coronally and apically. This in vitro study was done to evaluate the antimicrobial effect of Calcium Hydroxide (Ca(OH)$_2$), 2% Chlorhexidine (CHX), Triple Antibiotic Paste (TAP) and Chitosan nanoparticles (CSnps) against Enterococcus faecalis (E.faecalis), Streptococcus mutans(S.mutans) and Candida albicans(C.albicans).

Materials and Methods

Root canals of 180 freshly extracted single rooted permanent mandibular premolar human teeth with straight canals were standardized to a uniform length of 16mm after decoronation. All the root canals were instrumented with the sequence of Universal Protaper rotary system according to the manufacturer’s instructions. The coronal two-thirds of the canals were prepared with the shaping files SX. Subsequently rotary instrumentation was accomplished to working length using S1, S2, F1, F2 and finally F3. The samples were sterilized in an autoclave at 120°C for 15 minutes. Then the samples were broadly divided into three main groups with a sample size of 60 teeth (n=60). Each group of samples were contaminated with their respective organisms namely E. faecalis, S.mutans and C.albicans and incubated for 21 days. The samples were further subdivided into four experimental subgroups and one control group (n=12). The teeth in each subgroup were treated with one of the experimental medicaments namely Ca(OH)$_2$, CHX, TAP and CSnps. Microbial samples were obtained from the root canals after 7 days and optical density of the
culture was obtained after 24 hrs of incubation using spectrophotometer. The Culture density was calculated from the obtained optical density values.

**Statistical Analysis**

Data were analyzed statistically using Statistical Package for Social Sciences, (SPSS) version – 10 Software for Windows. Data were expressed in its mean and standard deviation and were analyzed using one way ANOVA and Student “t” test.

**Results**

There was a significant reduction in the microbial count for all the medicaments tested when compared with the culture group (p Value < 0.05). CSnps (E.faecalis 9.4043%, S.mutans 9.8635%, C.albicans 52.4408%) displayed the highest antibacterial efficacy and Ca(OH)₂ (E.faecalis 74.9883%, S.mutans 76.395%, C.albicans 83.2334%), the least. CHX (E.faecalis 20.7217%, S.mutans 37.3200%) showed similar antibacterial activity to CSnps (E.faecalis 9.4043%, S.mutans 9.8635%) but antifungal activity of CHX (C.albicans 77.1233%) was similar to Ca(OH)₂ (C.albicans 83.2334%) and TAP (C.albicans 80.1833%). Antimicrobial activity of TAP (E.faecalis 57.8725%, S.mutans 65.9350%, C.albicans 80.1833%) was similar to Ca(OH)₂ (E.faecalis 74.9883%, S.mutans 76.395%, C.albicans- 83.2334%).


Conclusion

Within the limitations of the present study, it can be concluded that

1. All the four medicaments used in this study exhibited significant reduction in bacterial count in experimentally infected root canals.

2. Chitosan nanoparticles (CSnps) had the highest antimicrobial effect against *E. faecalis*, *S. mutans* and *C. albicans*, compared to 2% Chlorhexidine (CHX), Triple Antibiotic Paste (TAP) and Calcium Hydroxide Ca(OH)$_2$. Hence it can be considered as an alternative intracanal medicament to commercially available Ca(OH)$_2$.

3. CHX showed a promising antibacterial activity, but its antifungal activity was similar to TAP and Ca(OH)$_2$.

4. Antimicrobial activity of TAP was superior to Ca(OH)$_2$ with no statistical significant difference but inferior to CHX and CSnps.

5. Ca(OH)$_2$ was least effective against all the three microorganisms when compared to all the tested organisms, hence its use as intracanal medicament should be minimized and use of other medicaments should be encouraged.

**Keywords:**